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AUTHOR Groff, Warren H.
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ABSTRACT

Our current transformation to a computer literate, high technology, information society has numerous implications for a new role for postsecondary education. To help define its own role, North Central Technical College (NCTC) has developed a strategic planning and human resource development model that specifies assumptions on which to base subsequent planning and then states goals and objectives. NCTC has used this model to project its data/word processing needs for the next several years and to implement an institutional commitment to computer literacy. Within postsecondary education as a whole, the implications of the coming information society can be seen with respect to both internal and external planning. Factors relevant to institutional planning include the increasing problem of illiteracy; changes that technological advancements have made in technical fields, such as engineering; the growing role of data and information processing in almost every occupational field; the professional preparation and continuing education of instructors in technical fields; the educator's new role as learning facilitator; and the expansion of institutional planning, management, and evaluation to include needs assessment, market analysis, environmental scanning and trend analysis. In the past, postsecondary education's relationship to the economy has been seen in terms of providing an educated workforce. The future will require a new proactive role in facilitating the transition to an information society. (KL)

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COMPUTER LITERACY: DATA AND INFORMATION PROCESSING AS THE CORE OF THE HIGH TECHNOLOGY, INFORMATION SOCIETY

by

Warren H. Groff, Ed. D.

Vice President for Academic Affairs

North Central Technical College

presented at

The Great Lakes Regional Conference of

The American Technical Education Association

Toledo, Ohio

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ABSTRACT

The history of the development of human society can be traced from the hunting society through the agricultural society to the industrial society. During recent years we have experienced the onset of a transformation to a new type of society. Masuda indicates:

> Mankind is now entering a period of transformation from an industrial society to an information society.... Man is now standing at the threshold of a period of innovation in a new societal technology based on the combination of computer and communications technology, quite unlike any of the past. Its substance is information, which is invisible. This new societal technology will bring about societal transformation which, in a double sense, is unprecendented.

This transformation to the information society is concerned with the shift from physical productivity of material goods to information productivity and can be expected to bring about fundamental changes in human values, in trends of thought, and in the political and economic structures of society. This learning and information society will be characterized as interactions between people and ideas and knowledge.

Data processing and management information systems in the past have tended to focus on data elements relating to internal operations of the institution such as registration, scheduling, class rosters, space utilization, grade reporting, student aid, payroll, budgeting and other administrative applications. Although the processing of data elements which are essentially internal to the institution will continue to be an important factor in decision making, the higher education planning process is becoming increasingly more dependent upon data elements external to the institution. Beyond managing institutions, data and information processing is rapidly becoming the core mode for the delivery of services and/or the production of durable goods.

This paper will describe a strategic planning process and human resource development model which is helping a small two-year college prepare for the computer literate, high technology, information society.

Background on the College's Planning Process

Over the past five years, North Central Technical College has developed a strategic planning and human resource development model in order to remain viable in the years ahead. The College examined numerous planning models from private and public regional universities and two-year colleges. The best models specified assumptions on which to base subsequent planning and then stated goals and objectives. The College specified assumptions under ten categories and goals under seven categories at the institutional and departmental levels. These categories are as follows:

Assumptions Categories	Goals and Objectives Categories
1. Societal Context	1. Mission Attainment
2. External Agencies	2. Functional Relationships
3. Institutional Management	3. Qualitative Improvement
4. Programs	4. Program Development
5. Students and Enrollment	5. Professional Development
6. Student Services	6. Public Relations
7. Professional Development	7. Funding Sources
8. Physical Plant	
9. Equipment	
10. Fiscal resources	

Dollars are linked directly to stated goals and objectives and reviewed by a College Budget Committee comprised of twelve persons representative of the various groups within the college community.

In August 1979, the President' Cabinet established a Data Processing Task Force to study the data processing/word processing needs of the College for the next several years. The DPTF surveyed all departments in an effort to develop a description of the future data processing environment. This description was sent to six vendors with an invitation to obtain additional information personally from all departments, submit a written proposal, and make a presentation. The DPTF analyzed critically the six proposals based on dimensions of the data processing environment including conversion, state of the art technology, software capability, growth potential, terminal

acceptability, hardware and software support, maintenance, security, word or text processing, space requirements, reliability, and other variables. Site visits and inquiries were made to colleges and corporations using various equipment configurations. A matrix evaluation form, using the above-stated criteria and vendor, was used to make the analysis as objective as possible. The two finalists were asked to make an additional presentation to an expanded group including persons from the Data Processing Program Advisory Committee and to complete a questionnaire developed by the group. After considerable analysis, the DPTF recommended unanimously that the College select the Hewlett Packard 3000-44. The Board of Trustees approved the recommendation on October 1, 1981. The College began the conversion to the new system almost immediately.

A capital appropriations bill contained $210,000 in technical education equipment funds and $1.8 m for equipment linked to a $3½ m building renovation project. In order to make wise use of these funds, the President's Cabinet, Academic Council, and other key persons, held a discussion on strategic goal areas on January 26, 1982. These strategic goal areas were as follows:

I. Information Processing
   A. Computer Literacy
   B. The Office of the Future or the Paperless Office

II. Electronic Delivery of Educational Programs and Services
   A. Interactive Diagnostic and Instructional Systems
   B. Telecommunications and Teleconferencing Systems

III. High Technology
   A. Advanced Machine Tool Design
   B. Microelectronics
   C. Robotics
   D. Lightwave Circuit Technology

Computer literacy can range from the ability to read a printout through systems analysis and design. Between these two ends of the computer literacy continuum would be such competencies as (1) the use of word processing equipment as input; (2) use of optical mark sensing equipment in test grading and upgrading the student data base; (3) computer assisted or managed instruction,

either using a "canned" program or writing a program; (4) conducting longitudinal studies of student progress; (5) a broad range of applications in business and industry such as statistical quality control, inventory control, computer assisted design (CAD) and computer assisted manufacturing (CAM); and (6) language proficiency in a broad range of data processing engineering contexts. (See FIGURE 1) Equipment decisions were then made to purchase selected items from the $210,000 authorization and other items from the $1.8 m authorization, including a HP 3000-64 for the Data Processing Program.

The College went through a similar experience with word processing. The strategic goal area of the office of the future or the paperless office includes (1) word processing, (2) personal computers, (3) electronic mail (4) computer assisted retrieval, (5) computer output microfilm, (6) facsimile devices, (7) teleconferencing, and reprographics. (See FIGURE 2) Specification sheets were designed by a Word Processing Task Force and mailed to vendors. The WPTF listened to presentations from nine vendors the first two weeks of June. Selected vendors were asked to demonstrate, on-site, the interaction of their equipment with the HP 3000.

Planning for the High Technology, Information Society

At the 1974 CAUSE Conference, John D. Millett, former Executive Vice President of the Academy for Educational Development and Chancellor Emeritus of the Ohio Board of Regents, stated that the largest single challenge facing higher education was that of planning. He stated:

> Planning for the future is the largest challenge facing higher education today. It is a challenge that can only be met with the courage to innovate, the will to influence events rather than to surrender to them. But the courage to innovate and the will to change have some hope of achievement only if information analysis and assessment have preceded action.
>
> Higher education management needs information. And then higher education management needs the capacity to know how to use information as the basis for trying to achieve a desirable tomorrow. Just as human

FIGURE 1

ELEMENTS OF THE STRATEGIC GOAL OF
COMPUTER LITERACY

Systems Analysis and Design

Language Proficiency
- Data Processing
- Engineering

Application
- Computer Aided Design (CAD)
- Computer Aided Manufacturing (CAM)
- Inventory Control
- Statistical Quality Control

Conducting Longitudinal Studies of Student Progress

Computer Assisted/Managed Instruction
- Writing a Program
- Using a Program

Use of Optical Mark Sensing Equipment
- Upgrading Student Data Base
- Test Grading

Use of Word Processing Equipment As Input

Reading a Printout

FIGURE 2

ELEMENTS OF THE STRATEGIC GOAL OF

THE OFFICE OF THE FUTURE OR THE PAPERLESS OFFICE*

WORD PROCESSING

development, revision, and production of documents such as letters, reports, labels, and directories.

PERSONAL COMPUTERS

small but powerful computers that can provide groups of users with capabilities such as filing, retrieval, sorting, word processing and report creation without the need for extensive programming or reliance on a large central processor.

ELECTRONIC MAIL

electronic work stations and message systems to send messages to one or more addresses where the communications can be read on their electronic equipment and respond at their convenience.

COMPUTER ASSISTED RETRIEVAL (CAR)

a combination of a computer system and a microfilm storage and retrieval device to get information from massive files that are stored on roll microfilm or microfiche.

COMPUTER OUTPUT MICROFILM (COM)

a computer process which produces information on microfilm instead of on paper.

FACSIMILE DEVICES

a way of transmitting pages of copy, such as correspondence or contracts, over long distances.

TELECONFERENCING

a method of simultaneous remote communication involving many people that may be as simple as a speakerphone conference call or as elaborate as a live video conference with terminals or facsimile devices for transmitting images, whether graphic or narrative.

REPROGRAPHICS

the use of electronics in the preparation of documents that can include input of original text through word processors linked directly to electronically controlled equipment that can set type in a multitude of type styles and sizes as well as automatically generate logos, form outlines, and charts and graphs.

*Source: H. Gerald Moody, "The Face of the Future: The Office," Voc Ed, January/February, 1982, pp. 36 and 83.

> intelligence is our product, so also is human intelligence our only hope for the future of higher education itself.[1]

During the post World War II years institutional planning had a focus on acquiring more resources and building facilities for the increased number of students resulting from the equal right demand for access to postsecondary education. Planning in postsecondary education during the 1960s was undertaken in response to immediate needs with minimum regard to the future. During the 1970s the influx of traditional 18 to 22 year old students began to stabilize. Many private and public senior institutions began to experience the impact of a broad range of demographic, social, political, and economic forces. As a result, organizations such as The Council for the Advancement of Small Colleges (now The Council of Independent Colleges), the Academy for Educational Development and the American Association of State Colleges and Universities launched programs relating to comprehensive institutional planning. These projects and others like it all stressed the need to assess the external environment. The literature began to reflect descriptions of institutional planning processes including some way to assess the external environment.[2]

The history of the development of human society can be traced from the hunting society through the agricultural society to the industrial society. In the hunting society, mankind was concerned primarily with extracting things from nature. The transformation to the agricultural society was slow and based on rather simple technological innovation. The hunting and agriculture societies can be characterized as interactions between people and nature. In comparison, the transformation from the agricultural society to the industrial society occurred more quickly and was the result of technological advances in energy, transportation, communications, raw materials, and research and development networks. The industrial society can be characterized as interactions between people and goods or fabricated

nature. More recently, advances in the industrial society have been the result of the integration of macro technological systems, the aggregation of complex technological developments in each of the above mentioned networks.

During recent years we have experienced the onset of a transformation to a new type of society. Masuda indicates:

> Mankind is now entering a period of transformation from an industrial society to an information society.... Man is now standing at the threshold of a period of innovation in a new societal technology based on the combination of computer and communications technology, quite unlike any of the past. Its substance is information, which is invisible. This new societal technology will bring about societal transformation which, in a double sense, is unprecendented.[3]

This transformation to the information society is concerned with the shift from physical productivity of material goods to information productivity and can be expected to bring about fundamental changes in human values, in trends of thought, and in the political and economic structures of society. This learning and information society will be characterized as interactions between people and ideas and knowledge.

Implications for Postsecondary Education

The onset of a transformation to a new type of society is occurring at a time when illiteracy is a major problem in this nation. Numerous articles have been written in recent years about the growing number of functionally incompetent,[4] scientific illiterate.[5] and the growing illiteracy problem for business when employees lack reading and writing skills necessary for their work.[6] An article in the Boston Sunday Globe indicated that it is scandalous that Johnny and Janie cannot write when they enter college "but it is perhaps less scandalous than the possibility that, when they emerge as bachelors of arts or science, they may be unable to describe either discipline in acceptable written English."[7] The problem is compounded when

to these forms of illiteracy are added (1) occupational illiteracy, (2) economic illiteracy, (3) research illiteracy, (4) management systems illiteracy (5) information processing illiteracy, and (6) technologic illiteracy. Human resource development, the prevention of human obsolescence, is the biggest challenge to postsecondary education in the years ahead. Implication of the onset of the high technology, information society will be discussed in terms of (1) curriculum and (2) institutional planning, management, and evaluation.

The institutional commitment to computer literacy carries with it a mandate for human resource development. In the field of engineering, for example, increasing competition in world markets has made manufacturers realize that they must do more with less, and do it better. Many manufacturers feel that an investment in technology will help them become more effective and efficient in what they do. Technological advances have been made in the design, engineering and manufacturing processes through Computer Aided Design (CAD), Computer Aided Engineering (CAE), and Computer Aided Manufacturing (CAM). Other terms used to describe technological advances include Group Technology, Manufacturing Planning and Control Systems, Automoted Materials Handling, Materials Requirements Planning (MRP), scheduling approaches such as Automated Time Standards (ATS), Computer Assisted Process Planning, and Manufacturing Resources Planning (MRPII). When these technological advances are combined in an effort to move toward the "Factory of the Future," the combination is referred to as Computer Integrated Manufacturing or Integrated Computer Aided Manufacturing.

Similar changes are occuring in business extending from market research through consumer satisfaction and in health care extending from health promotion through tertiary, long-term, extended care.

In this discussion it is not important to understand in detail the technological advances in any of these industries or the unique distinctions of any of the above-mentioned systems. What is important to understand, however, is that data and information processing is rapidly becoming a required competency in almost every occupational field. As such, data and information processing competencies take their place alongside other competencies which are required as the core undergraduate curriculum.

A good example which can be applied to most occupational fields is the concept of inventory. Inventory could mean (1) raw materials to make components, (2) components to make products, or (3) distribution of products to meet consumer demands. The acquisition, storing, retrieving, and redistribution of inventory is costly to any industry, particularly the educational and information industries. Library orientations are designed to acquaint learners to the inventory of raw materials (theories, ideas, concepts, principles) of the education and information industries. To what extent do we introduce learners to inventories of data and information bases which are automated and stored in various respositories?

The concept of inventory is particularly important to the professional educator in technical programs in two-year colleges. Professional preparation and professional continuing education is an extraordinarily complex task today. Most faculty were graduated from undergraduate and graduate programs which focused on service delivery as opposed to educator roles. Their programs tended to concentrate on competence in relationship to performance of a role other than learning facilitator. Their programs dealt minimally, if at all, with curriculum content formats, packaging formats, or learning outcomes evaluation formats. Nor did they concentrate on stages of adult development and distinctions between pedagogical and androgogical principles. Just as it is important for elementary school teachers to understand principles of human growth and development for the relatively homogeneous populations they serve, so too is

it important for the professional educators in postsecondary education to understand the increasingly heterogeneous populations they serve. Yet, to what extent are professional educators in technical programs familiar with the inventory of tools to assist them in their role as learning facilitator?

For example, federal legislation in 1954 and 1963 created a series of nine research and development centers to engage in R & D in education. In 1965, P.L. 89-10 created a network of twenty regional educational laboratories to translate the results of this R and D into products that could be used in education and training. Although the number of such laboratories has been reduced to seventeen over the years, the primary function of this system continues to focus on the generation of new knowledge and the reduction of the lag between R & D and its dissemination and adoption. This system is coordinated, to some extent, through the Council for Educational Development and Research.

Another tool which has evolved over time is the system of Educational Resource Information Centers (ERIC). ERIC is a system of seventeen clearinghouses which are repositories of documents ranging from pure through applied E & D for a variety of areas such as adult, career, and vocational education; counseling and personnel services; educational management; higher education; information resources; junior colleges; reading and communications skills; and other topics. An example of the value of these tools is apparent in the Spring 1982 issue of the ERIC Junior College Resource Review entitled Literacy In Community College. To what extent do we utilize the inventory of tools to improve different types of literacy and the quality of the education and training industry? (See Appendix A for a list of ERIC Clearinghouses)

Implications of the onset of the computer literate, high technology, information society extends beyond the curriculum and relates directly to institutional planning, management, and evaluation. Gollattscheck and others express the implications in terms of a new role for American postsecondary

education. They state:

> We believe the time has come for a fourth major development in American postsecondary education: the creation of the community renewal college. The deterioration of our communities, the increasing inability of individuals to cope with rapid change, the obsolescence of individuals and social organizations, and the increasing number of citizens with educational needs who are beyond the purview of existing colleges demand a new kind of postsecondary institution. This new college must be committed to the improvement of all aspects of community life....[8]

Data processing and management information systems in the past have tended to focus on data elements relating to internal operations of the institution such as registration, scheduling, class rosters, space utilization, grade reporting, student aid, payroll, budgeting and other administrative applications. Although the processing of data elements which are essentially internal to the institution will continue to be an important factor in decision making, the higher education planning process is becoming increasingly more dependent upon data elements external to the institution.

An example of the community renewal college can be seen in the concepts of technology transfer and human resource development. As indicated earlier in this document, many manufacturers feel that an investment in technology will help them become more effective and efficient in what they do. If a college makes a commitment to technology transfer and human resource development for business and industry in its service area, it needs a management information system relating to that market segment. That is to say, the college needs some way (1) to identify types of establishments in its service area, (2) to deliver technology transfer and human resource development services, and (3) to measure outcomes and impact analysis.

The U.S. Department of Commerce, Bureau of the Census, produces a series of reports that represents an extension of the existing County Business Patterns program which has been published annually since 1964 and at irregular intervals prior to that year. The series of reports starting with 1974 provide

data covering most of the economic divisions of the economy, i.e., agricultural services, construction, manufacturing, wholesale trade, retail trade, finance, insurance, real estate, and services. Research indicates that 80% of the new jobs are created by establishments no more than 4 years of age and with 20 or fewer employees.[9] Cooper and Dunkelberg found that most entrepreneurs started their companies when they were 25 to 40; many are highly educated with 36% having 16 or more years of schooling; and about 50% had entrepreneural parents.[10] This type of approach suggests that a college needs an MIS - market analysis capability which yields information about the number of types of establishments by employment size, some information about the entrepreneurial nature of its corporate leadership, and information about the stage of development of the corporation. (FIGURE 3 is a display of the first of these three dimensions)

Development follows diagnosis. Assume for discussion purposes that the college's strategic planning process suggests that the greatest return on investment could be realized from concentrating on selected types of small manufacturing establishments. The college can then concentrate its technology transfer and human resource development delivery system on these few establishments and also conduct an outcomes and impact evaluation.

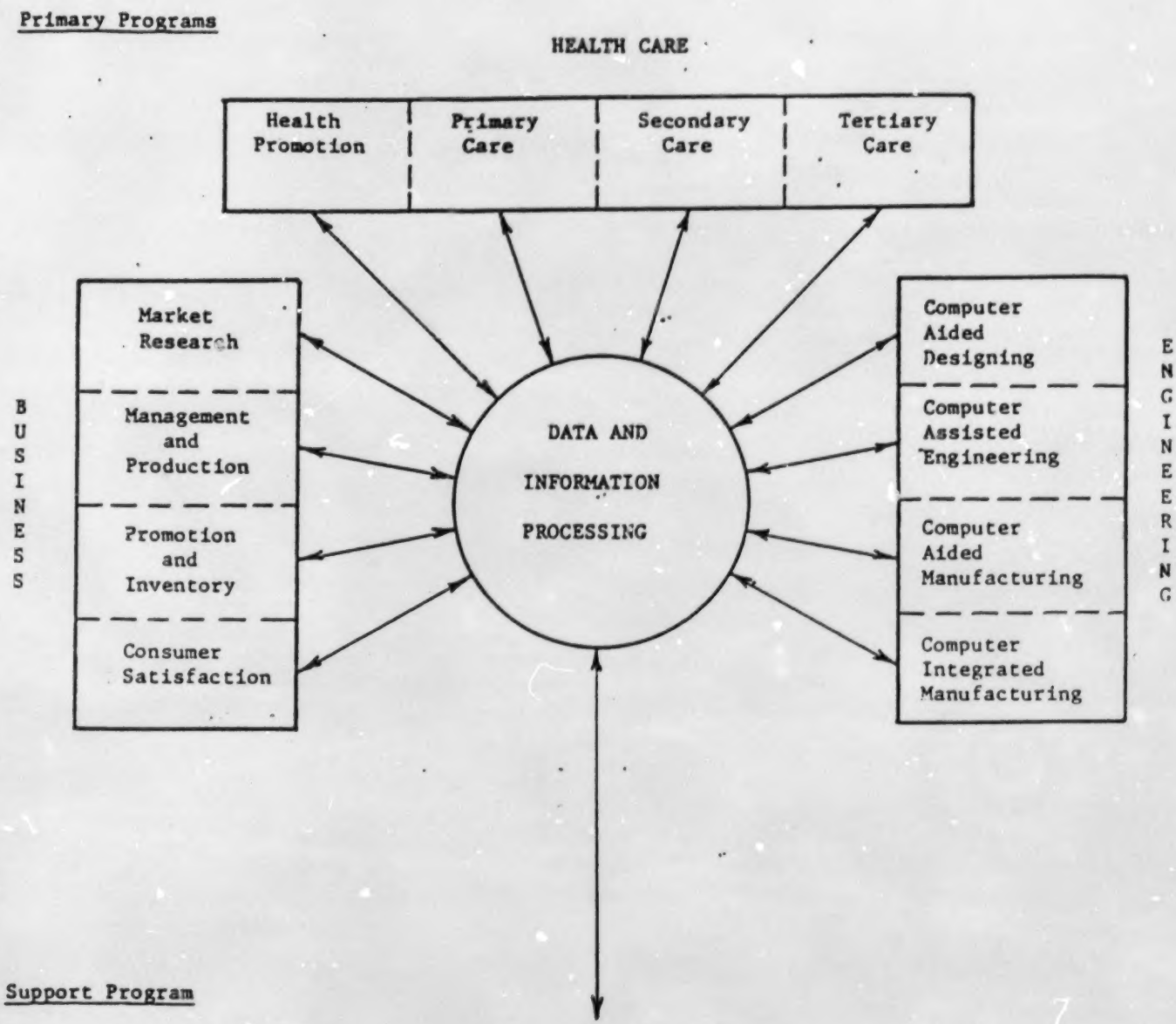
The point of the above-described example is to illustrate how the data and information processing requirements will extend the range of range of planning, management, and evaluation tasks to include needs assessment, market analysis, environmental scanning and trend analysis as well as outcomes and impact analysis functions. FIGURE 4 is a display of the relationship of data and information processing as the core of the high technology information society for primary and support programs.

Summary

The transformation to a computer literate, high technology, information society has numerous implications for a new role for postsecondary education.

FIGURE 4

DATA AND INFORMATION PROCESSING AS THE CORE
OF THE HIGH TECHNOLOGY INFORMATION SOCIETY



These implications hold for primary programs in business, engineering, and health care as well as support programs such as institutional strategic planning, management, and evaluation. Institutions must develop strategic planning and management processes which help keep them viable in the years ahead. Such processes will mandate computer literacy competencies for all personnel. Masat has expressed the need for computer technology and literacy as follows:

> Computer technology and literacy are two of our nation's most important resources. With about half the labor force holding information and computer-related jobs and earning more than half the labor income, information has become our major national commodity. Moreover, our society has become irreversibly dependent on computers, particularly in the areas of business, energy, space exploration, research, and national security. Our ability to use computer technology thus contributes significantly to our nation's present and future intellectual and economic strengths. For colleges and universities, computer literacy is increasingly needed for research and development, for efficient and effective management, and for the use of sophisticated technological equipment.

Numerous issues will be important in the 1980's. No issue, however, will be as important as the relationship of postsecondary occupational education to the economy. Foreign competition, technological advances, changes in productivity, high cost, plant and human obsolescence, and infrastructure deterioration have resulted in massive dislocations in our economy. In the past, postsecondary education has seen its relationship to the economy primarily in terms of providing an educated workforce. In the future, this focus will continue to be important but not sufficient. New, expanded relationships will be required between postsecondary education and the economy in the computer literate, high technology, information society. Is postsecondary education prepared to take a proactive role with regard to computer literacy in the transformation to the high technology, information society?

A - ERIC CLEARINGHOUSES

ERIC Clearinghouse on Adult, Career, and Vocational Education
Ohio State University
Center for Vocational Education
1960 Kenny Road
Columbus, Ohio 43210
Telephone: (614) 486-3655

ERIC Clearinghouse on Counseling and Personnel Services
University of Michigan
School of Education Building, Room 2108
Ann Arbor, Michigan 48109
Telephone: (313) 764-9492

ERIC Clearinghouse on Educational Management
University of Oregon
Eugene, Oregon 97403
Telephone: (503) 686-5043

ERIC Clearinghouse on Elementary and Early Childhood Education
University of Illinois
College of Education
Urbana, Illinois 61801
Telephone: (217) 333-1386

ERIC Clearinghouse on Handicapped and Gifted Children
Council for Exceptional Children
1920 Association Drive
Reston, Virginia 22091
Telephone: (703) 620-3660

ERIC Clearinghouse on Higher Education
George Washington University
One Dupont Circle, Suite 630
Washington, D.C. 20036
Telephone: (202) 296-2597

ERIC Clearinghouse on Information Resources
Syracuse University
School of Education
Syracuse, New York 13210
Telephone: (315) 423-3640

ERIC Clearinghouse for Junior Colleges
University of California at Los Angeles
Powell Library, Room 96
Los Angeles, California 90024
Telephone: (213) 825-3931

ERIC Clearinghouse on Languages and Linguistics
Center for Applied Linguistics
1611 North Kent Street
Arlington, Virginia 22209
Telephone: (703) 528-4312

ERIC Clearinghouse on Reading and Communication Skills
National Council of Teachers of English
1111 Kenyon Road
Urbana, Illinois 61801
Telephone: (217) 328-3870

ERIC Clearinghouse on Rural Education and Small Schools
New Mexico State University
Box 3AP
Las Cruces, New Mexico 88003
Telephone: (505) 646-2623

ERIC Clearinghouse for Science, Mathematics, and Environmental Education
Ohio State University
1200 Chambers Road, Third Floor
Columbus, Ohio 43212
Telephone: (614) 422-6717

ERIC Clearinghouse for Social Studies/Social Science Education
855 Broadway
Boulder, Colorado 80302
Telephone: (303) 492-8434

ERIC Clearinghouse on Teacher Education
American Association of Colleges for Teacher Education
One Dupont Circle, N.W., Suite 616
Washington, D.C. 20036
Telephone: (202) 293-7280

ERIC Clearinghouse on Tests, Measurement, and Evaluation
Educational Testing Service
Princeton, New Jersey 08541
Telephone: (609) 921-9000 Ext. 2176

Educational Resources Information Center
Central ERIC
National Institute of Education
Washington, D.C. 20208
Telephone: (202) 254-7934

ERIC Clearinghouse on Urban Education
Box 40
Teachers College, Columbia University
Telephone: (212) 678-3437

FOOTNOTES

[1] John D. Millett, "Management and Information in Higher Education," Proceedings of the 1974 CAUSE National Conference (Boulder, Colorado: CAUSE, 1974).

[2] Descriptions of institutional planning processes including external assessment:

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Warren H. Groff, "Trend Analysis As A Management Tool In Planning Technical Education In The Eighties," presented at the First Global Conference on The Future of the World Future Society, July 20-24, 1980.

Warren H. Groff, "Environmental Trend Analysis and Strategic Decision-Making: A New Role for Collegiate Cooperation," presented at the Annual Meeting of the Council for Interinstitutional Leadership, October 26-28, 1980.

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[3] Yoneji Masuda, The Information Society As Post-Industrial Society (Tokyo, Japan: Institute for the Information Society, 1980).

[4] "Ahead: A Nation of Illiterates?" U. S. News and World Report, May 17, 1982, pp. 53-57.

[5] Frank Kotulak, "Are Americans Sinking Into Scientific Illiteracy?" News Journal, February 21, 1982, p. 3-C

[6] Sheila Tefft, "Illiteracy Problem For Businesses," News Journal, February 28, 1982, p. 1-E.

[7] David B. Wilson, "The Graduates Can't Write: Illiteracy In America?" Boston Sunday Globe, May 17, 1981, p. 1 +.

8
James F. Gollattscheck, Ervin L. Harlacher, Eleanor Roberts, and Benjamin R. Wygal, College Leadership for Community Renewal, (San Francisco: Jossey-Bass, 1976).

9
Michael Barker, Director of Policy Studies for the Council of State Planning Agencies of the National Governors Conference. Cited by William Souder in "The War Between the States", TWA Ambassador, December 1981, pp. 23-26.

10
Arnold C. Cooper and William C. Dunkelberg, "A New Look at Business Entry: Experiences of 1805 Entrepreneurs," presented at the Conference on Frontiers of Entrepreneruship Research, Babson College, Boston, April 13, 1981.

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Frances E. Masat, Computer Literacy in Higher Education AAHE ERIC/Higher Education Research Report No. 6, 1981, p. 1.

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